CMS/LHC Update
Beam Splash!

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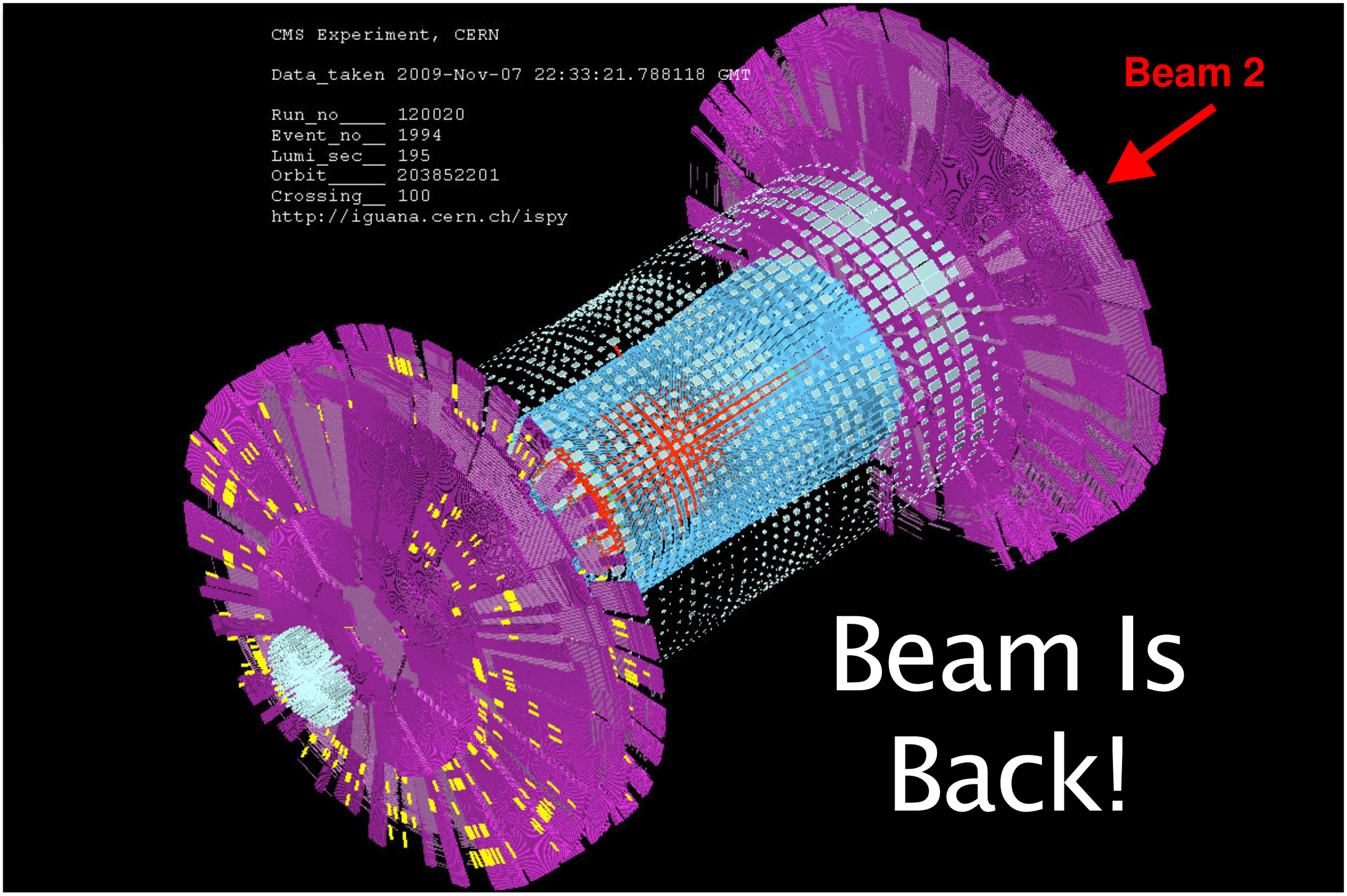
All Experimenters Meeting
16 November 2009

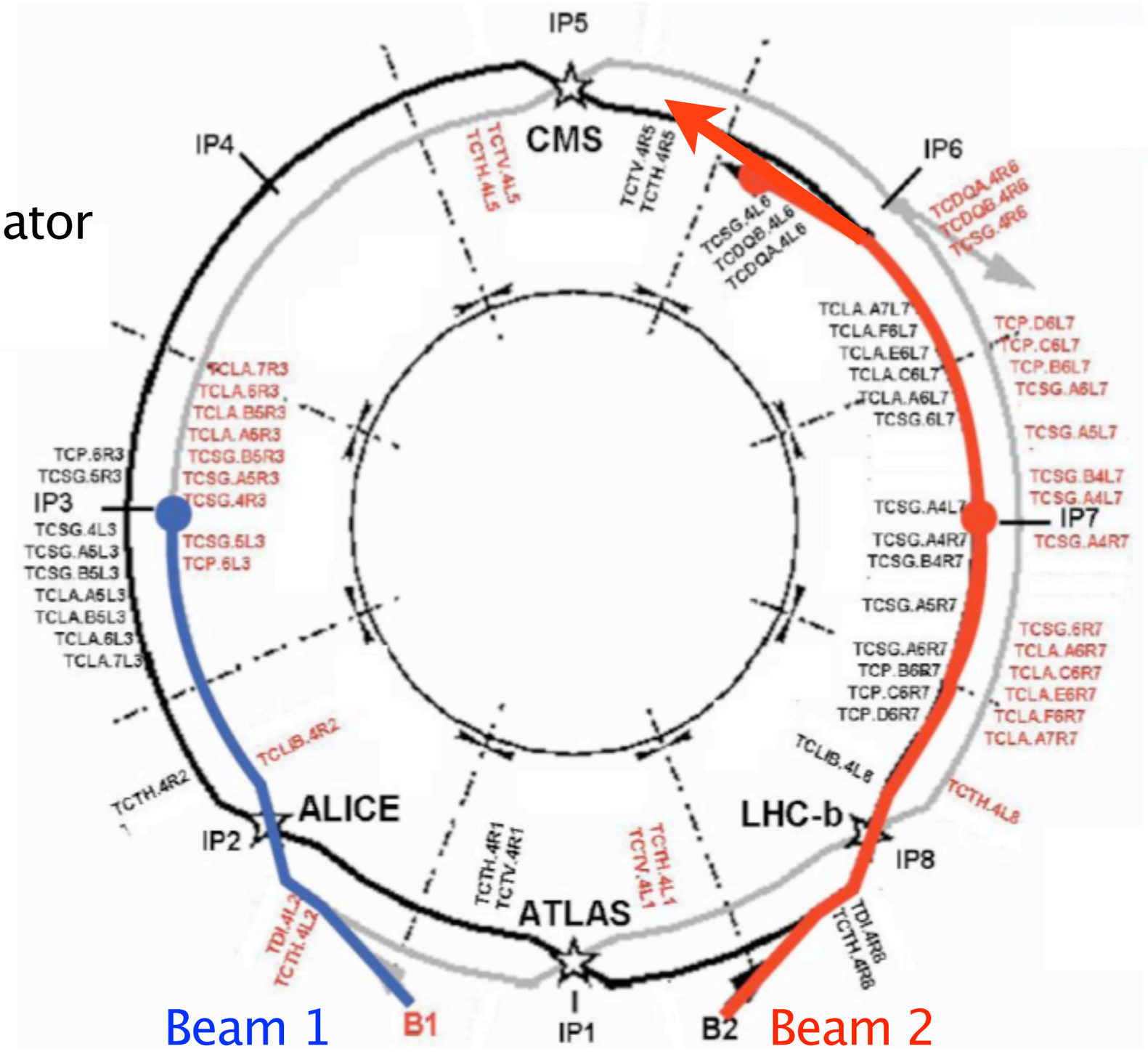

CMS Experiment, CERN
Data_taken 2009-Nov-07 22:33:21.788118 GMT
Run_no____ 120020
Event_no__ 1994
Lumi_sec__ 195
Orbit_____ 203852201
Crossing__ 100
http://iguana.cern.ch/ispy
Beam 2
Beam Is Back!

Beam Splash Summary

- LHC delivered “beam splash” events to CMS on weekend of 7/8 November.
- Successful commissioning for LHC:
    - Check of optics and dispersion.
    - Aperture scans.
    - Collimator and beam loss monitor tuning.
    - Injection channel studies.
- Great success for CMS:
    - Online systems (trigger, detector, data acquisition) performed very well.
    - Event reconstruction on Tier0 computing farm made data available to offline teams within minutes.
    - Offline teams (at CERN, FNAL, and other places) began analyzing data within hours.

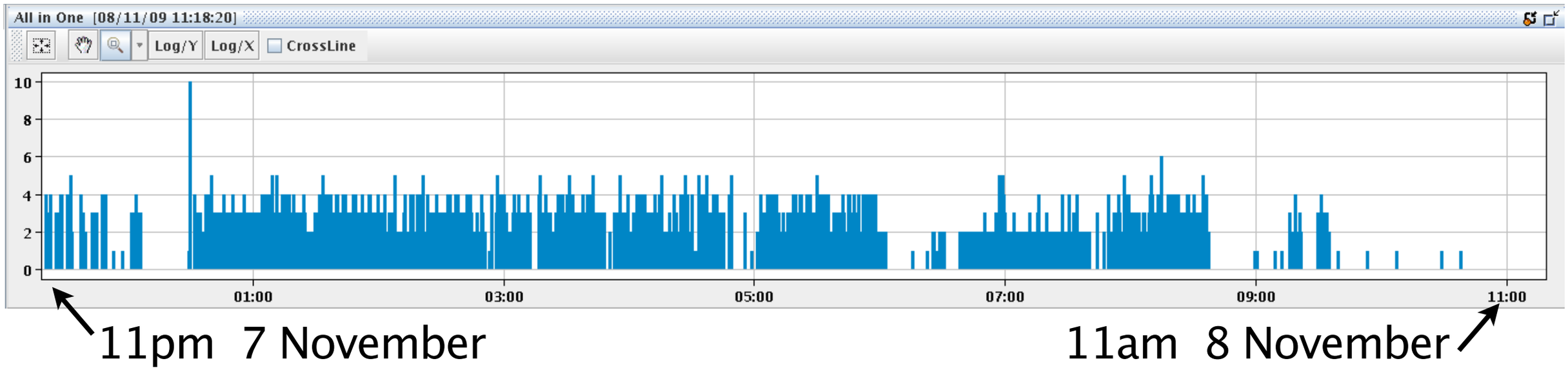
Injection Test Cartoon

- Injection test performed sector-by-sector.
- Beam 2 steered into collimator ~150 meters from CMS.
- 5 x 10^9 protons/bunch.
- Resulting "wall of muons" hits CMS from -z direction.
- 1 shot every 40 seconds.



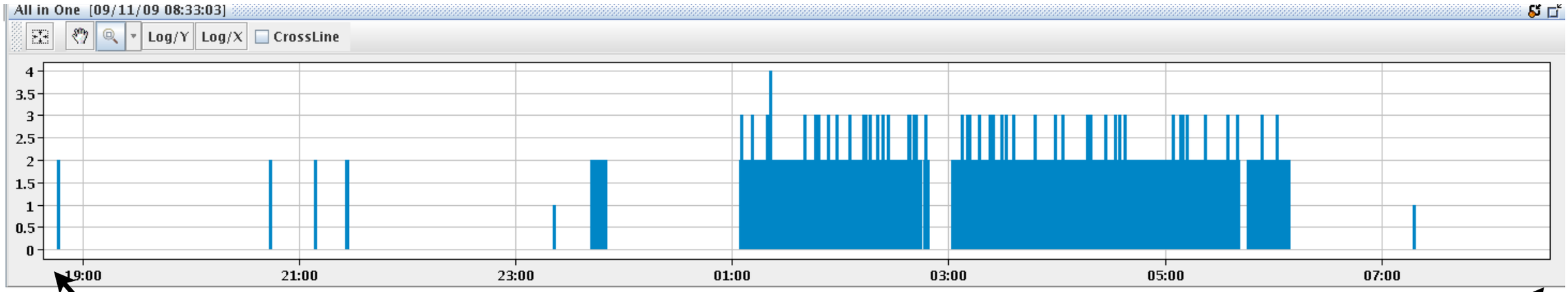
Beam Splash Events

- 1105 shots in 19 hours from 7 Nov – 9 Nov.
- CMS beam scintillation counter trigger history:



11pm 7 November

11am 8 November



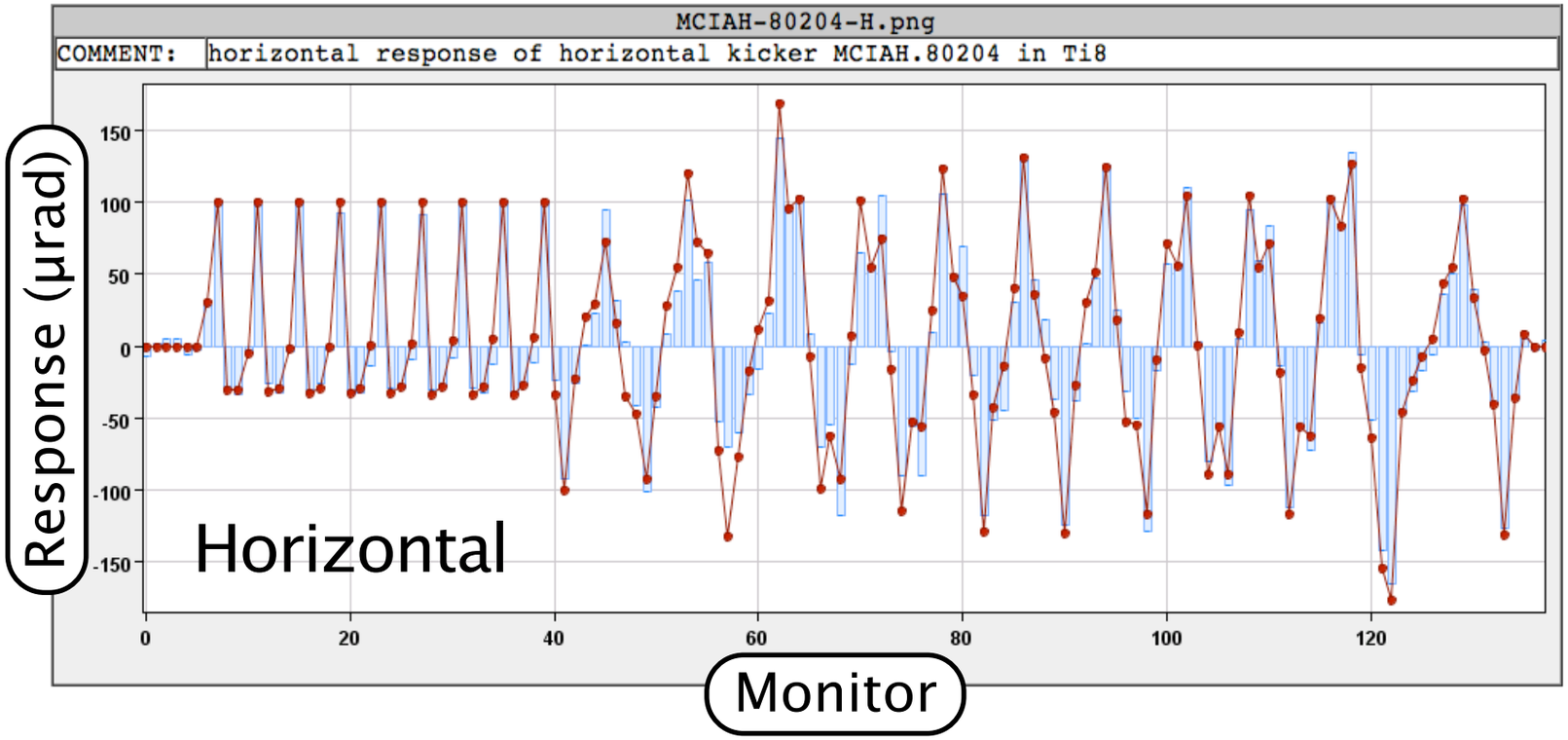
7pm 8 November

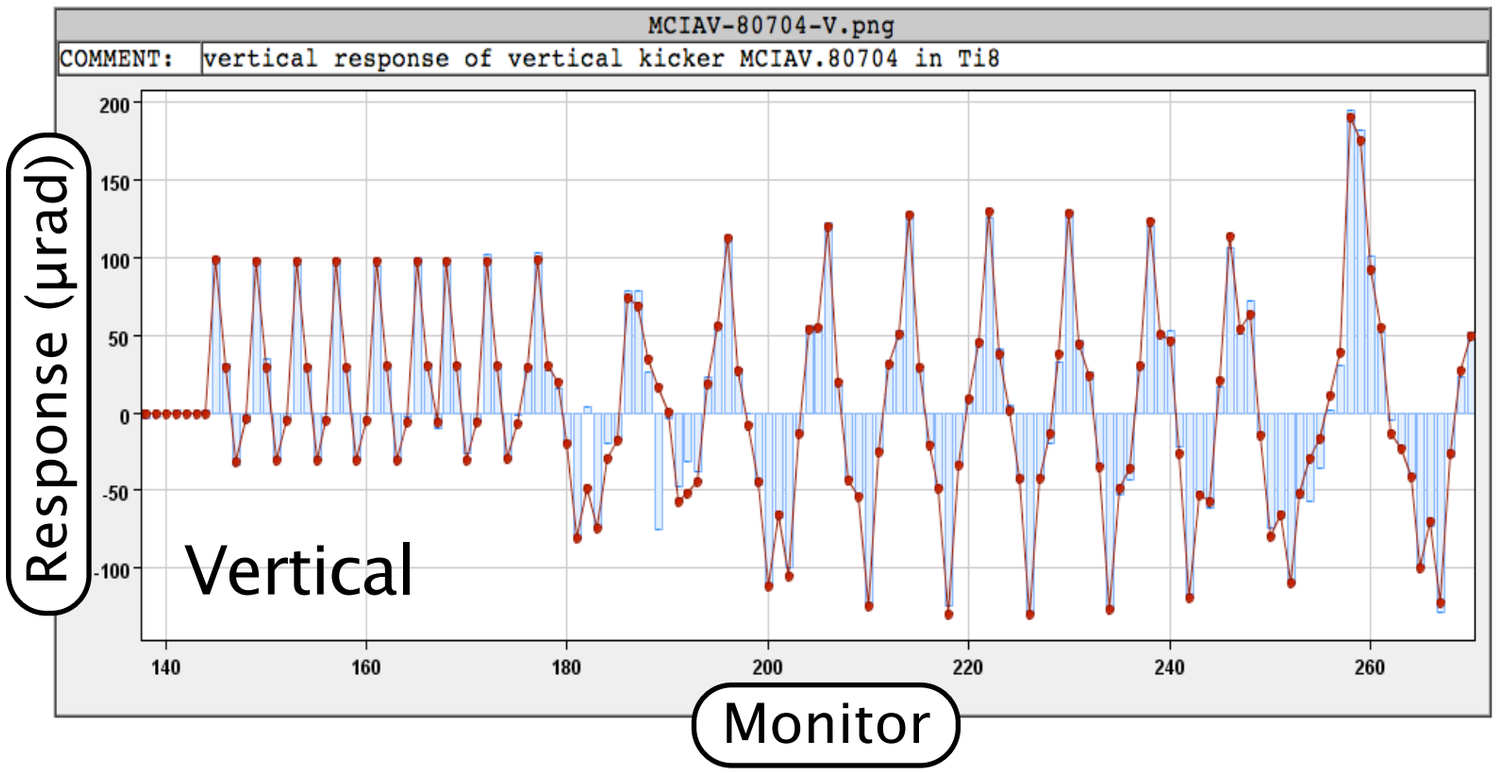
8am 8 November

- (Y-axes are in arbitrary units.)

Checking LHC Optics

- Beam kicked and oscillation measured by beam position monitors (BPM).

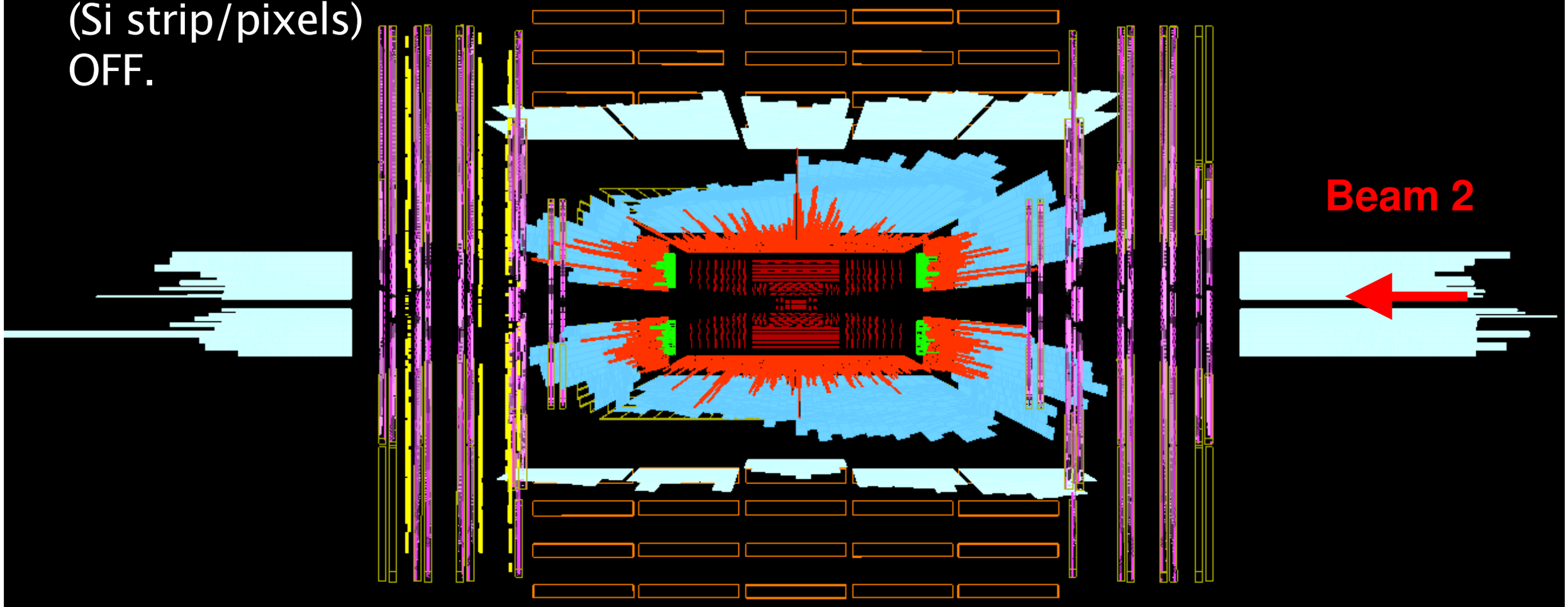




- Solid line: Mathematical model.
- Histogram: BPM measurements.

CMS State during Splash

- Solenoid at 3.8T.
- Tracking systems (Si strip/pixels) OFF.
- Muon systems (DT, CSC, RPC) ON at reduced HV. (Upstream RPC OFF.)

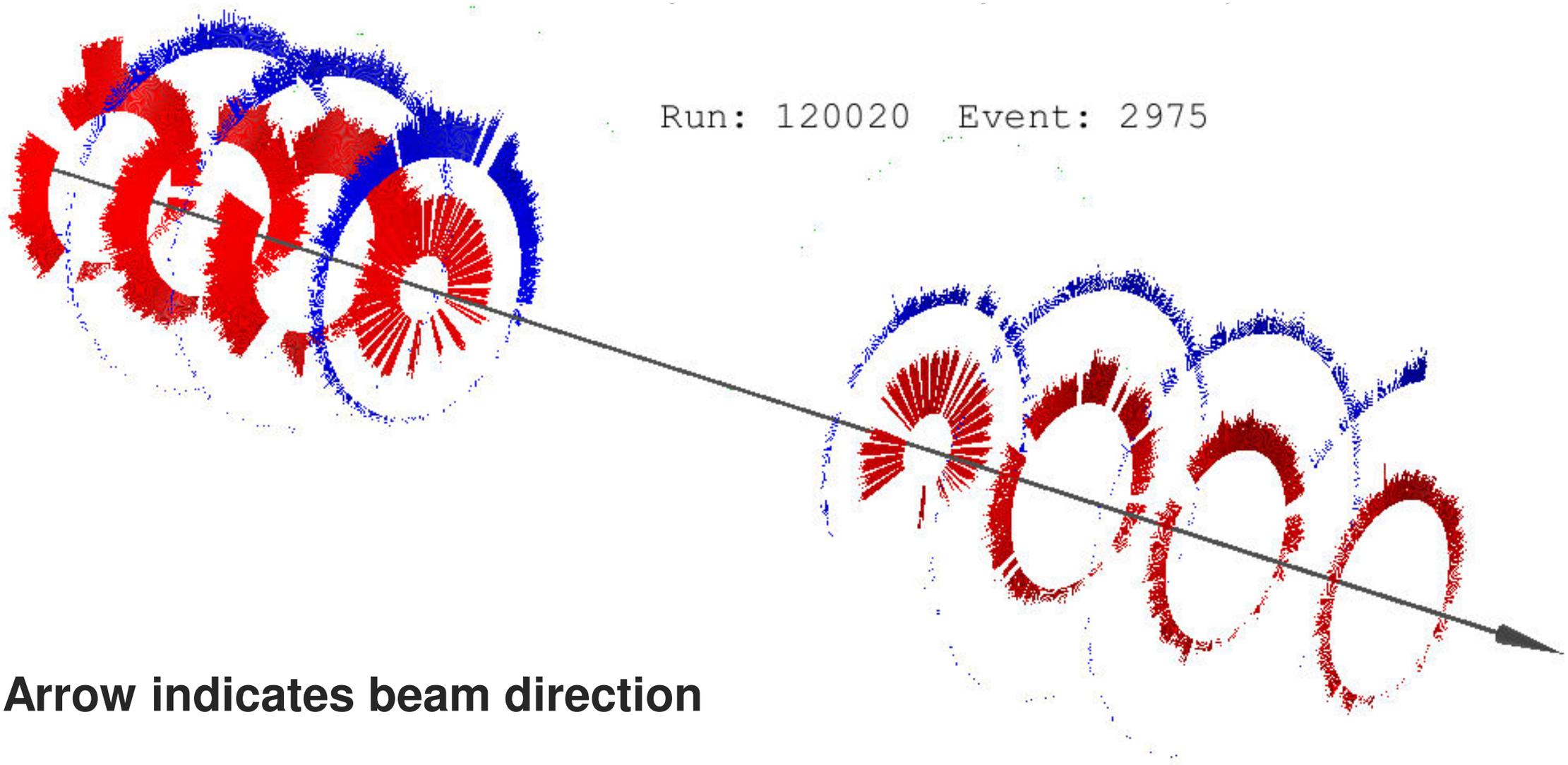


- Electromagnetic calorimeter and preshower ON.
- Hadronic calorimeters ON: Barrel, Endcap, Forward, Outer

- Triggered on energy in central η ring of ECAL : Trigger fired for all shots.

Muon System : Cathode Strip Chambers

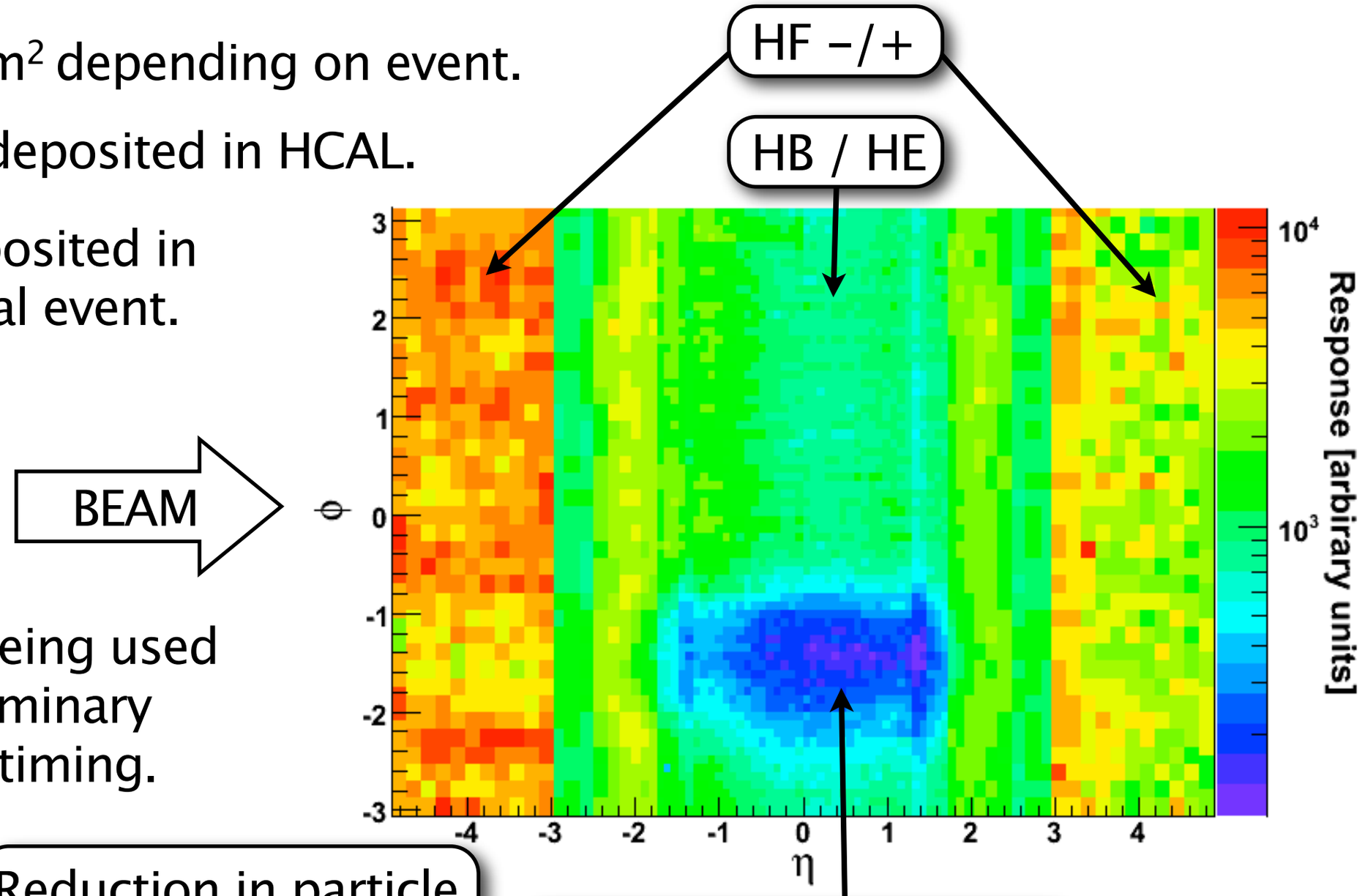
- Upstream detectors delayed to be “in-time” with downstream detectors.
- One segment for each cathode strip (blue outer, red inner) with length proportional to charge.



Arrow indicates beam direction

Hadronic Calorimeter (HCAL)

- No dead channels in barrel (HB), endcap (HE), or forward (HF) calorimeters.
- 2–20 muons/cm^2 depending on event.
- ~2 GeV/muon deposited in HCAL.
- Several PeV deposited in HCAL in a typical event.
- Splash events being used to validate preliminary calibration and timing.



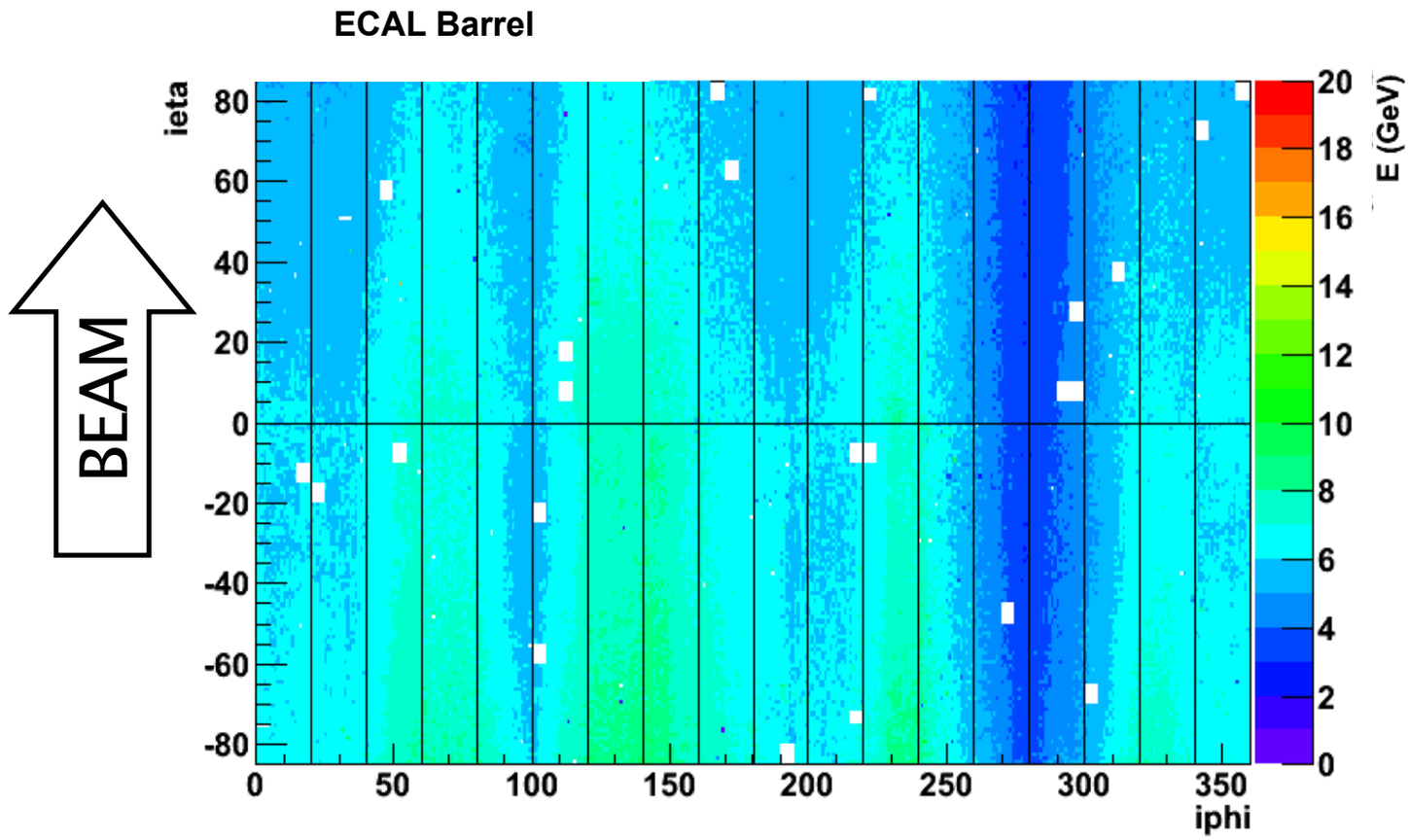
Reduction in particle flux evident in ±HF difference.

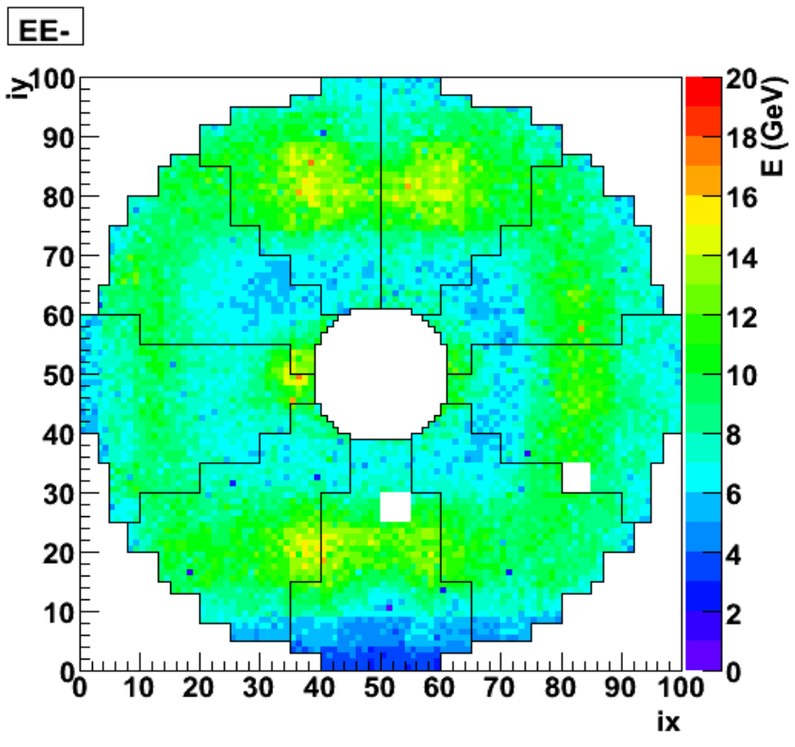
Material and hall floor in front of CMS.

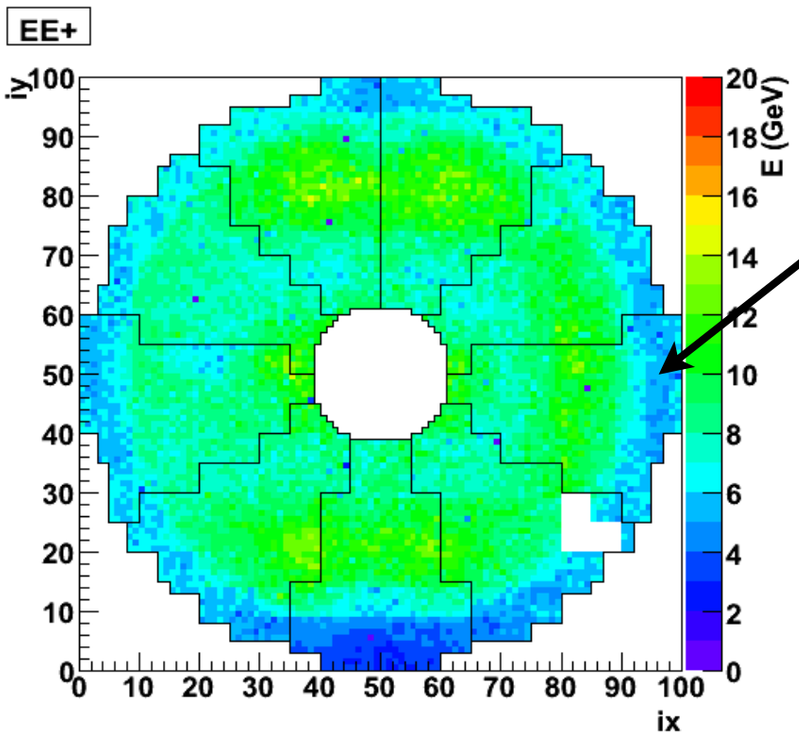
Electromagnetic Calorimeter (ECAL)

- White regions (0.9%) are masked channels – 25% of which will be recovered.

- Energy difference in ± Endcaps consistent with ~25% muon flux reduction due to stopped muons.



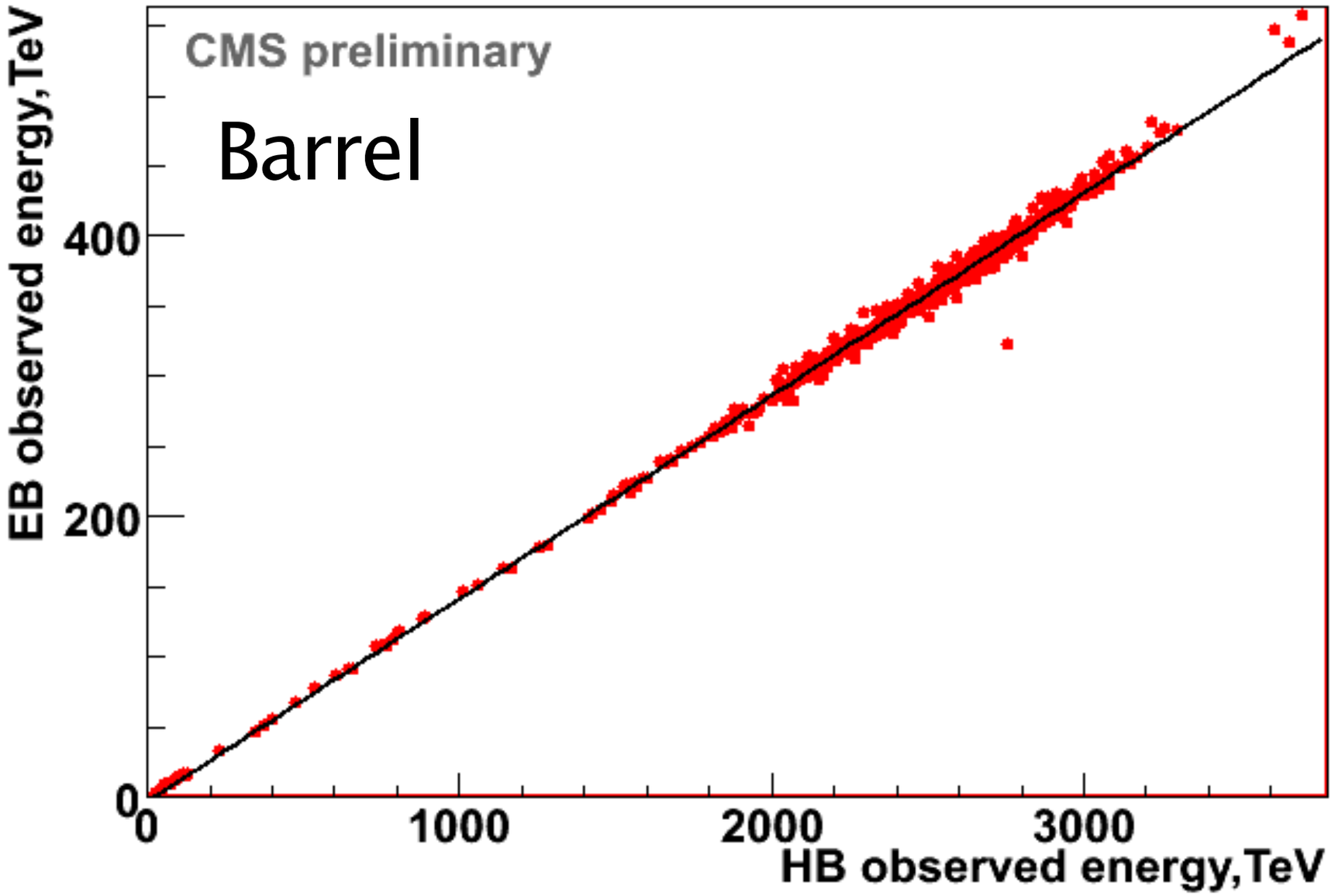




Low energy at large radius due to attenuation in ECAL barrel shield.

ECAL vs. HCAL Response

- ECAL vs. HCAL response for splash events with a wide range of energies:



Machine Status & Plans

- As of 13 Nov, 7/8 sectors commissioned at injection energy (450 GeV).
  - 1 sector delayed due to faulty quench heater power supply, which is being replaced.
- As of 13 Nov, >5/8 sectors commissioned at 2 kA (1.1 TeV).
- Planned schedule:
  - Commissioning finished by 18 Nov, followed by cold checkout.
  - Circulating beam by weekend of 21/22 November, commissioning includes:
    - A few beam splashes from other side of CMS.
    - RF capture.
    - Test detector beam dump signals.
    - >4 hrs single beam for testing of beam radiation monitoring system and background studies.
  - Colliding beam (450-on-450 GeV) two weeks after circulating beam.
    - To start, 2x2 bunches with 5×10^{10} protons/bunch.

CMS Status & Plans

- 5am 9 Nov: “Glitch” in CMS solenoid cryogenics system caused magnet to ramp down to 2.3T.
- Magnet now OFF, but scheduled to ramp to 3.8T on 18 November.
- CMS is suggesting to LHC operations to attempt first circulating beams (~21 Nov) with CMS solenoid ON to save commissioning time.
    - If problems with beam/field coupling, immediately ramp down CMS solenoid.
- CMS is “ready” for collision data, but working hard to be even “more ready”:
    - Morning of 13 Nov: CMS went from all detectors OFF to global running with all detectors ON in 5 hours.
    - This is acceptable, but can be better.

Finally … The Bird Incident

- 3 November: A bird dropped baguette into an outdoor electrical installation causing a short circuit that interrupted operation of the cooling system.
- The failsafe system performed as designed.
- The bird was not harmed.